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ENHANCING PERFORMANCE IN SMES: A CONCEPTUAL FRAMEWORK FOR AI ADOPTION THROUGH DIGITAL READINESS AND EMPLOYEE DIGITAL SKILLS

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Abstract:

In today's rapidly changing digital era, the adoption of Artificial Intelligence (AI) is transforming business operations by enhancing efficiency, innovation, and productivity. Small and Medium-sized Enterprises (SMEs), which play a vital role in driving economic growth, often struggle to leverage AI for competitive advantage. Despite the significant potential of AI to enhance SME performance, adoption rates remain relatively low due to technological and organizational barriers. This study applies the Technology-Organization-Environment (TOE) framework to investigate the factors influencing AI adoption in SMEs which impact on performance. This study, focuses on proposed conceptual model which combines technological factors (digital readiness) and organizational factors (employee digital skills) as key determinants of AI adoption. It seeks to bridge the gap in existing research by providing a structured approach to assess in-depth understanding into TOE constructs such as digital infrastructure readiness and employee digital skills. As a research proposal, this study will employ Exploratory Factor Analysis (EFA) and Reliability Analysis Cronbach's Alpha to validate the conceptual model, followed by Structural Equation Modelling (SEM) to examine relationships among key constructs. This finding will provide valuable insights for SMEs top management, government. policymakers and technology players by offering effective guidelines to enhance AI adoption and drive sustainable growth in the SMEs.

Keywords:

Artificial Intelligence (AI), Small and Medium-sized Enterprises (SMEs), Technology-Organization-Environment (TOE), Digital Readiness, Employee Digital Skills, SME Performance.

Introduction

Businesses are quickly changing through the integration of modern technologies. Digital transformation, which involves using digital tools and strategies to improve performance, has become crucial for businesses to stay competitive. Among the key drivers of digital transformation is Artificial Intelligence (AI). According to Boufedda and Abdelaziz (2024) the current transformation is characterized by the integration of artificial intelligence, information technology, and robotics into various aspects of business operations and society at large. Therefore, AI has the potential to transform business strategies and decision-making by improving efficiency, boosting effectiveness, and driving innovation (Gonesh et al., 2023). These advancements has help businesses operate more smoothly while minimizing errors and reducing costs.

The rapid advancement of AI technology has revolutionized the way industries operate, resulting in increased efficiency, productivity, and innovation (Rashid & Kausik, 2024). An analysis by EDBI and Kearney on the projected economic impact of Artificial Intelligence (AI) in Malaysia GDP expected 14% increase by 2030, contributing \$115 billion (Refer Figure 1). This figure underscores the huge economic potential of AI, highlighting Malaysia's significant stake in the AI landscape. This shows that, Malaysia reflecting their growing AI adoption and expected to see higher AI-driven GDP contribution as well as other Southeast Asian countries.

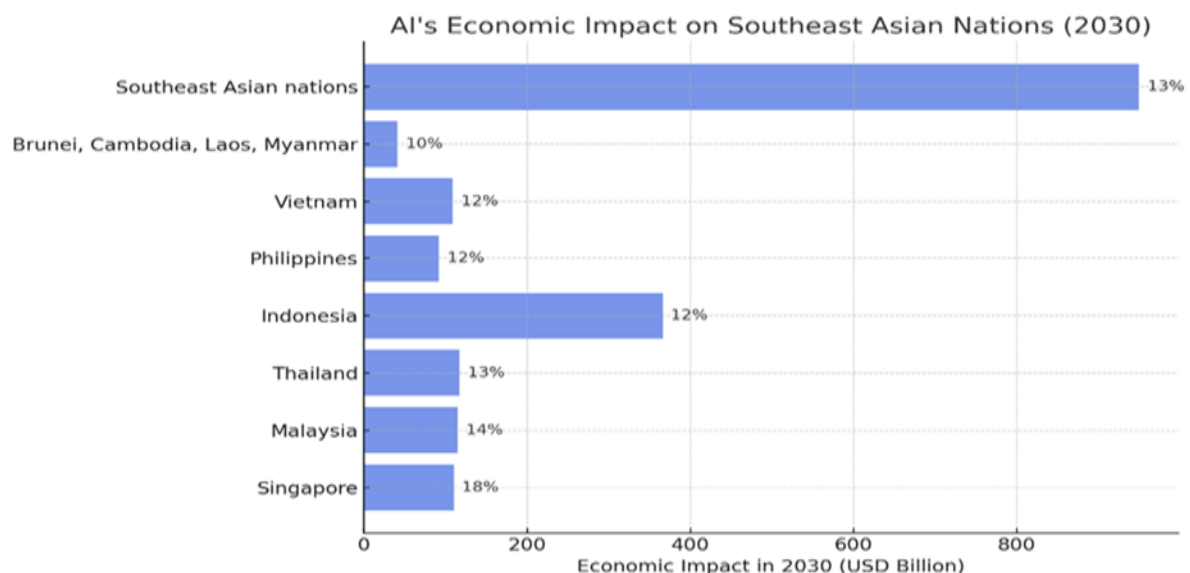


Figure 1: The Economic Impact of AI On Southeast Asian Nations by 2030

Source: EDBI and Kearney

However, despite the increasing integration of artificial intelligence (AI) in business operations, SMEs face significant challenges in leveraging AI for performance. The adoption rate among Malaysian SMEs remains significantly low. According to SME Corp Malaysia,

(2023), only 15% of SMEs have implemented AI in their operations, while over 60% are still in the early digitalization stage by using only basic digital tools. This indicates a substantial gap between the potential of AI and its actual uptake in SMEs level. Although, research underscores the importance of AI adoption in enhancing productivity and efficiency, much of the existing literature shows that large enterprises have higher levels of AI adoption compared to SMEs (Tominc et al., 2024). According to Yusuf et al. (2024), lack of awareness about AI's potential and cultural resistance to change create reluctance to adopt these technologies. Another organizational barrier is a lack of organizational support, which can be a barrier to the adoption of AI and digital technologies for SMEs (Badgish & Soomro, 2024; Ulrich, 2021). However, there was also an issue of sustainability and perception of complexity (Badghish & Soomro, 2024); Yusuf et al., 2024) reported limited financial resources can restrict SMEs' ability to invest in advanced technologies operate with constrained financial resources, making significant investments in AI solutions difficult. Furthermore, the lack of skilled professionals with AI expertise makes implementation even more challenging, underscoring the need to develop and nurture talent in this area. (Zavodna et al., 2024). Based on figure 2, The Sustainable Development Goals Report, 2024 outlines the key barriers that prevent SMEs from adopting AI. These include limited digital skills, lack of financial funding, organizational resistance to change, and low awareness of AI benefits. As a result, although AI offers great potential to improve SME performance, adoption rates remain low. This highlights the need for a deeper understanding of the factors influencing AI adoption and its effects on SME outcomes.

Challenges in Implementation

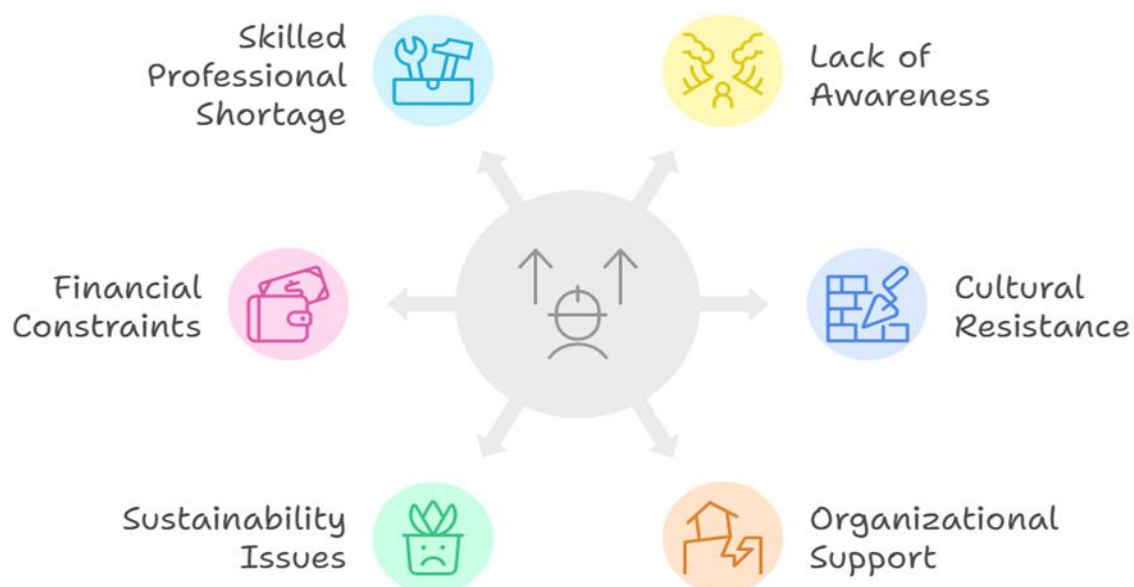


Figure 2: Challenges to AI Adoption

The Sustainable Development Goals Report 2024. United Nations

A critical issue that remains underexplored is the lack of management guidelines that SMEs can use to improve their digital readiness and labour skills in line with AI adoption. Initiatives of digital transformation are made in organizations, addressing the role and importance of leadership and employee's digital readiness (Michelotto & Joia, 2024). However, SMEs often lack the strategic frameworks necessary to bridge these gaps, leading to weak AI integration and limited performance gains.

In Malaysia, there is a significance lack of empirical studies investigating the factor of AI adoption within SMEs and how AI integration impacts SMEs performance. Additionally, the extent to which contextual factors such as digital readiness and employee digital skill affect AI adoption in SMEs remains underexplored. Given these gaps, it is supported to examine the primary drivers of AI adoption in SMEs and assess its impact on SMEs performance. Therefore, this study aims to fill TOE framework to facilitate AI adoption among SMEs, in order to drive economic growth and competitiveness. This studies primarily discuss digital readiness and employee digital skills as enablers of AI adoption. It is recommended by Faizan UI Haq et al. (2024) to incorporate constructs such as digital infrastructure readiness and employee digital skills, which may provide further insights into AI adoption barriers within SMEs. In addition, there is limited empirical evidence on how SMEs can systematically develop these capabilities to maximize the advantages of AI. By investigating the practical mechanisms through which digital readiness and employee digital skills influence AI adoption, this study aims to provide SMEs with actionable insights and ideas supported by data to improve their technological flexibility. This study narrows its scope to technological and organizational factors within the TOE framework, as these internal aspects are most actionable by SME. In contrast, environmental factors such as policy and market dynamics are acknowledged but excluded due to their external nature and limited controllability. The findings will not only contribute to the existing body of knowledge but also serve as a valuable resource for training institutions, SMEs owners and policymakers that seek to foster AI adoption in SMEs landscape.

Literature Review

Theoretical Framework: The Technology-Organization-Environment (TOE)

Tornatzky and Fleischer (1990) developed the TOE framework, which is one of the most commonly used models for understanding how organizations adopt new technologies. It contrasts with The Technology Acceptance Model (TAM) which primarily emphasizes user perceptions and makes it particularly suitable for understanding technology adoption at the individual level (Davis, 1989) and the Diffusion of Innovation (DOI) theory which highlights the characteristics of innovations (Rogers, 2003). TOE provides a balanced perspective by examining how internal organizational factors, technological capabilities, and external environmental influences to shape technology adoption decisions. (Salmizi et al., 2024), In the context of SMEs, prior studies examining the TOE framework have been carried out in several research fields. The research on the TOE framework in SMEs holds significant importance in developing technology adoption, promoting innovation, addressing challenges and enhancing competitiveness (Salmizi et al., 2024). Therefore, the potential future of the TOE framework in SMEs holds significant impacts for their competitiveness in the dynamic business environment. SMEs are essentials in driving economic growth, but face challenges to implement AI. In addition, by applying the TOE framework, researchers and SME owners can identify the predictors of influencing AI adoption and develop effective strategies to face any

challenges. Moreover, dimension of the framework such as technological, organizational and environmental have significantly impact on SMEs adoption of digital technology, which highlighting their vital roles in forming the adoption process (Arifia, 2024).

Digital Readiness

In the era of rapid development of technology, digital readiness has become a crucial factor influencing the successful adoption of AI in SMEs. Digital readiness describes an organization's preparedness to adopt and effectively utilize digital technologies, encompassing both human capabilities and technical infrastructure (Avtalion et al., 2024). On top of that, AI adoption encompasses intelligence shown by machine that imitates human cognitive process, such as decision-making and problem-solving (Rashid & Kausik, 2024). Therefore, when SMEs possess a high level of digital readiness, they are more likely to integrate AI quickly into their operations, which improves efficiency, increases competitiveness and lowering the costs in the market. Moreover, studies indicate that a key predictor in successful adoption is technology compatibility, which involves AI with the current information technology landscape and company's strategy (Almeida & Wasim, 2023). Since today's consumers are more reliant with social media, mobile devices and cloud computing, SMEs must embrace the waves of digital transformation. (Ammeran et al., 2023). Ultimately, digital readiness serves as a crucial predictor of AI adoption, ensuring that SMEs stay competitive in the rapidly growing AI-driven world.

Employee Digital Skill

In the context of organizational, it focuses on the internal characteristics of a business that impact adoption of technology. The lack of expertise of internal technical is a major barrier to AI adoption. Several organizational factors determine whether SMEs can successfully integrate AI into their operations. One of the most significant factors is labour skills. Therefore, SMEs may struggle to attract and retain skills due to their limited resources and smaller size compared to larger firms (Iyelolu et al., 2024). It is a widely discussed topic in AI adoption analyses about the need for AI-related skills in organizations (Waschull & Emmanouilidis, 2023). In addition, training initiatives that focus on AI technologies, digital literacy and innovation in operations can empower SME leaders and employees to effectively implement and utilize AI solutions (Iyelolu et al., 2024).

AI Adoption through the TOE Framework

While other technology adoption models such as the Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI) are widely used in the field of information systems, the TOE framework has been extensively used in the adoption of AI adoption. By examining the factors of TOE framework, it provides a comprehensive justification of AI adoption in SMEs, which highlighting both the opportunities and challenges. This framework influences technological factors, including compatibility, digital infrastructure and data management to enhance the digital economic growth which provides a holistic understanding of the internal and external factors (Stofarandova et al., 2023). On the other hand, organizational factors such as resource availability. employee digital skills and leadership commitment significantly influence the cultural readiness and internal environment of AI integration (Maestro & Rana, 2024). This study emphasizes technological and organizational dimensions due to identified need for specific organizational capabilities for technology adoption, although the TOE framework also encompasses environmental factors. In addition, this study emphasizes organizational and technological dimensions due to identified need for specific organizational

capacities for technology adoption. Therefore, this research indicate that digital readiness and employee digital skills are critical to the successful of AI adoption. According to Ramachandran et al. (2024), SMEs are more likely to adopt AI successfully if prioritize digital literacy and upskilling programs for employees. Similarly, Le et al. (2024) found that digital literacy improved self-learning and empowers employees to engage with AI technologies. Numerous prior studies have applied the TOE framework to examine AI adoption in different contexts, highlighting the crucial role of digital readiness and workforce skills in improving SMEs performance. The following table 1 summarizes key empirical studies that have employed the TOE framework in analysing AI adoption among SMEs.

Table 1: Summary of Studies supporting the Conceptual Framework

Researchers	TOE Focus	Methodology	Findings
(Avtaliaon et al., 2024)	Technological Factor (Digital Infrastructure)	Semi-structured interviews	Digital infrastructure serves as a key enabler for the successful integration of AI technologies in SMEs.
(Michelotto & Joia, 2024)	Technological Factor (Digital Infrastructure)	Quantitative	Digital readiness influences successful digital transformation in organizations.
(Chaudhuri et al., 2024)	Organizational factor (Employee digital skill)	SEM	Employees dynamic capabilities play a significant role in enhancing their skills and knowledge, which in turn strengthens their intention to embrace digital technology.
(Kozanoglu & Abedin, 2020)	Organizational factor (Employee digital skill)	SLR	Employee's literacy with digital is a multi-dimensional organizational ability that affects the use of technologies.
(Abaddi, 2024)	Organizational factor (Employee digital skill)	SEM	Employee's digital skills can affect how other variables influence to their intention to AI adoption.
(Oldemeyer et al., 2024)	Technological Factor (Digital Infrastructure)	SLR	Digital infrastructure was among the most common enabler to AI adoption in SMEs

AI Adoption and Its Impact on SMEs Performance

The adoption of AI technologies holds significant potential for enhancing SMEs economic performance (Soomro et al., 2025). However, SMEs often deal with intense market competition, limited resources and operational challenges which can hinder their growth. The adoption of AI presents an opportunity for SMEs to overcome these challenges and enhance their business performance. AI enables SMEs to automate processes, enhance rational flexibility, and introduce innovations that align with the demands of the digital economy (Faizan ul Haq et al., 2024), that allowing SMEs to operate more efficiently and competitively. Several empirical investigations have underscored the positive impact of AI on SMEs' performance. It is supported by Abaddi (2024), that identified key factors and moderators influencing the uptake of AI technologies in Jordanian SMEs, showing that strategic AI integration positively correlates with enhanced operational performance and market competitiveness. On top of that, Charllo (2024) highlighted the pivotal role of AI in empowering SMEs during the post-pandemic era, focusing on recovery and fostering innovation. This study explores how AI adoption influences key performance indicators in SMEs, including in financial and non-financial landscape.

Developing New Conceptual Framework

The conceptual framework is designed to structure the theoretical framework and define the research problem. Figure 3 illustrates the proposed model namely the determinants of AI adoption on SMEs Performance by integrating TOE model, which outlines the relationship of digital readiness and employee digital skill significantly influence AI adoption, which in turn to improve SME performance. The study indicates that although the TOE framework encompasses environmental factors, most research on digital transformation has predominantly focused on organizational and technological factor, with comparatively less emphasis on environmental factors in the existing literature (Jara et al., 2023). Therefore, this study emphasizes technological (digital readiness) and organizational dimensions (employee digital skill) addressing a significant gap in existing research due to the limited empirical findings on SMEs.

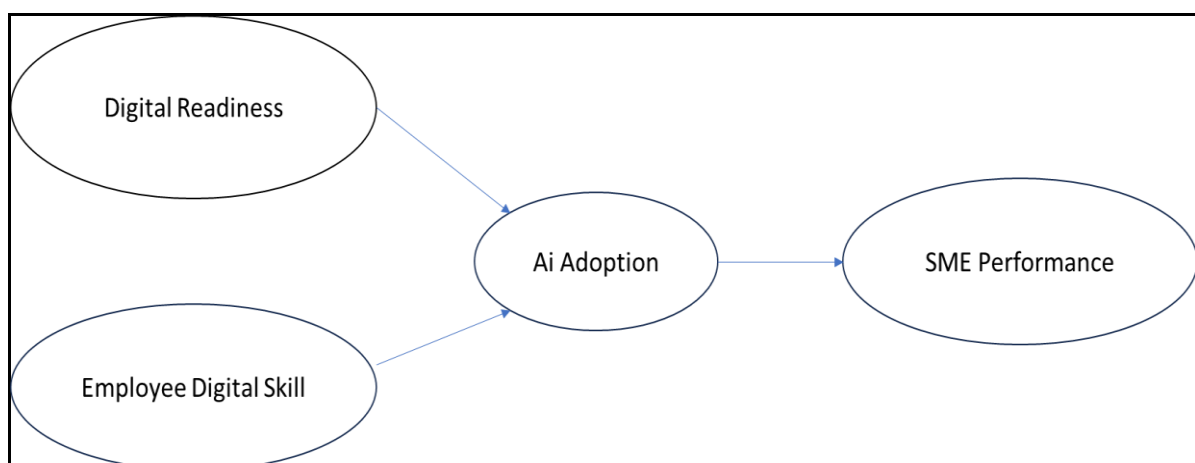


Figure 3: Proposed Conceptual Framework

Methodology

This study employs a qualitative research approach. The target respondents for the future empirical phase will consist of SME owners, managers, and decision-makers who are directly involved in technological initiatives within organizations. In addition, a simple random sampling technique will be used to select SMEs that have adopted AI solutions. Then, data will be collected primarily through an online structured questionnaire from SME directories provided by government agencies such as SME Corp Malaysia and related bodies. The study also utilizes a literature review methodology, drawing upon academic journals and global case studies to identify best practices and challenges in AI adoption, particularly within the context of the TOE framework. Since this study-based research project proposal, the next steps involve conducting Exploratory Factor Analysis (EFA) using pilot data, followed by Reliability Analysis Cronbach's Alpha and Structural Equation Modelling (SEM) to validate the relationships among the proposed constructs. These analyses are crucial to ensuring the durability and reliability of the conceptual framework and its applicability in guiding SMEs toward successful AI adoption.

Conceptual Findings and Discussion

In reviewing the literature and constructing the conceptual framework, all key objectives of this study have been conceptually addressed. The influence of digital readiness and employee digital skills on AI adoption has been supported by several recent empirical studies. The conceptual framework (refer Figure 3), effectively integrates these constructs using the TOE framework, particularly in technological and organizational factor. In addition, these factors illustrating their potential impact on SME performance. Furthermore, the identification of AI adoption challenges (refer Figure 2) and the national-level economic potential of AI in Figure 1 provides actionable insights. It directly supports the achievement of the objective of offering strategic recommendations to support AI adoption among Malaysian SMEs.

Contributions of the Study

This study offers valuable contributions to SMEs top management, government, policymakers and technology players. For academic perspective, it extends the application of the TOE framework by emphasizing two critical underexplored constructs (digital readiness and employee digital skill) in the context of developing economies. The proposed conceptual model provides a structured foundation for future study and theoretical advancement. Moreover, for industry, particularly SMEs owner and decision-makers, this study presents a practical roadmap to assess internal capabilities in digital infrastructure and employee upskilling to facilitate successful AI integration. Nationally, the research supports Malaysia's aspirations under the Twelfth Malaysia Plan and the MyDIGITAL initiative by empowering SMEs with actionable strategies to enhance productivity, innovation, and competitiveness through AI adoption.

Conclusion

The TOE framework has been used to analyse AI adoption in various context in SMEs. Therefore, it has emerged as a paradigm for critical research for understanding digital transformation in businesses. The TOE framework is appropriate to link performance of AI adoption with technological, organizational and environmental factors (Chen et al., 2023). Furthermore, the use of AI has the potential to provide positive results which can increase economic and operational performance of SMEs (Badghish & Soomro, 2024). Initially, this study proposes a new conceptual model by integrating two essential factors namely digital

readiness and employee digital skill in technological and organizational factors within TOE framework. Due to the fact that, it has not been thoroughly examined in the context of AI adoption and SMEs performance.

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